SMART GRID CONSULTANCY
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NATIONAL GRID ELECTRICITY DISTRIBUTION

FLEXIBLE OPERATION OF WATER NETWORKS ENABLING RESPONSE SERVICES (FLOWERS)

D4-1 SPECIFICATION AND HIGH-LEVEL ARCHITECTURE

VERSION 1.1

1 TABLE OF CONTENTS

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2 PROJECT OVERVIEW

The FLOWERS project will analyse the potential ability of South West Water's (SWW) network to embed energy flexibility capacity in the time difference (latency) between when drinking water and wastewater are pumped and stored, and when it is used by the system. It will explore methods of delivering latency flexibility and analyse the feasibility of implementing it on SWW's systems. It will define the regulatory compliance and commercial viability requirements for the creation of a latency flexibility product, which can be embedded within National Grid Electricity Distribution's (NGED) electricity network control rooms. If appropriate, a recommendations document will be produced identifying the next steps for the development of latency flexibility capacity in ED2.

3 DOCUMENT PURPOSE

This document is one of several that will be published throughout the projects' lifecycle, which is primarily a desktop-based analysis that is designed to establish the efficacy and scale of potential innovations discussed in the previous section. The project will require the engagement of both water and electricity regulators to determine whether benefits will be permitted to go forward to BaU.

The intention of the following sections is to focus on the anticipated flexibility capacity, that could be realised based on the research carried out during the project to date and the operational dependencies that have been identified, which affect the amount of energy consumed (currently over 300 GWh) by SWW's demanding Drinking Water (DW) and Wastewater (WW) processes.

While there may be some capacity that can be harnessed easily by the water authority and offered to the Electricity Networks to assist with the objective of whole system efficiency / optimisation, it is anticipated that the majority will need further investment of time, money, and system development to release. There have been substantial efforts expended to identify the potential of different energy demand processes and generation potential that could contribute to proposed programme. This is summarised in the D3-1 document entitled "Anticipated Southwest Water Available Capacity". This D4-1 document sets out the functionality necessary to enable this to be realised.

4 PROBLEM STATEMENT

The specific problem that this report is intending to resolve is the development of methodologies that harness the potential when the proposed perturbations are applied to the SWW estate and thereafter the wider industry as a whole.

An ongoing problem is that within the SWW and much of the water industry's sites, there are very limited capabilities that would typically be associated with selling electricity flexibility. These include but not limited to;

- Submeters and meters with sufficient granularity to provide ½ hourly or minute by minute data
- Continuous data communications for the necessary fields.
- Remote asset control covering the necessary parameters / functions.
- Generator synchronising permissions
- Generator controls and adequate fuel stores

The outputs within this document are largely derived from the desktop analysis that has been carried out and the extensive experience within the project team in enabling remote operations and process automation. No physical demonstrations have yet taken place and it is expected that the methods described will be the focus of any follow-up initiative to establish the veracity of these initial findings.

As a result of the limitations to existing capabilities, the volume of easily accessible flexibility is understandably very low. This is not unexpected, otherwise we would have historically observed far greater participation within existing Flexibility Programmes to ESO, TSO and more recently DSO, through the standard tendering processes.

Unfortunately, the barriers to accessing the market versus the limited returns on offer under the conventional rewards structure has proven to be an insufficient incentive to releasing the full potential contained within the water industry. Through a better understanding of the value of flexibility from the water industry to a DSO and theoretical cost versus reward it is hoped that we will be able to release a significant volume of untapped capacity.

5 APPROACH

Further to the analysis that has been carried out and documented in the D3-1 report we assessed what will be necessary to implement the proposed upgrades to achieve the potential flexibility. Rather than attempting this on a site-by-site basis and incorporate all the specific nuances relating to specific locational challenges, operational differences and technical specifications of their actual assets, a broad categorisation method has been used.

The summary table, at the end of this section 5, outlines the 16 use cases that have been identified and used to initially estimate the likely potential that water authorities, and more specifically what South West Water could contribute to embedded flexibility. These have been separated initially by the timeframe it can be reasonably expected to achieve the behaviour change that would achieve the flexible capacity delivery.

At its most conservative approach this would simply involve a pre-emptive shift of behaviour that is not dispatchable. Instead, the sites that would be required to pre-schedule the variation in behaviour in advance for a minimum of a season. This could be in line with the traditional definition of seasons being Spring, Summer, Autumn and Winter or the alternative generally employed by the electricity industry. This contains six seasons of varying length but ensures that we reflect the impact of clock changes resulting from Daylight Savings Time. The specific dates for each year are subject to slight change as all of the transitions take place on a Monday at 5am (with the exception of 1st April), but follow the same general pattern.

For example, the 2022/3 seasons are;

- S1 1st April 2022 – 2nd May
- S2 2nd May 2022 – 22nd August
- S3 22nd August 2022 – 26th September
- S4 26th September 2022 – 24th October
- S5 24th October 2022 – 23rd January
- S6 23rd January 2023 – 1st April

At the more dynamic end of the potential service use cases there will be the need for a mechanism with which to dispatch the flexible capacity based on forecasting or even live operational conditions. These are not viable at the moment as there is no existing systems capability to monitor and control all sites directly or via a centralised control room.

It is assumed that the use cases study will point towards an increase in potential value and usefulness. This is largely down to the enhanced ability to use the perturbation on a more targeted basis but also at shorter notice which may permit the capacity to be used in more critical scenarios such as post-fault events. It is likely that following the FLOWERS project completion there will be subsequent investigations through innovation to determine the feasibility of evolving the capabilities and scope of the flexibility potential through the ongoing development of remote monitoring and control within the water industry in pursuit of improved whole system optimisation. For simplicity we have categorised the 16 use cases in the table into 5 sections which should be easily identified by means of the colour differentiation.

5.1 Method A

Use cases 1-4 are the main area where we expect to encounter sites that have real potential that could be released with negligible effort and investment. This is largely down to the dispatch method, which is the main defining difference between each of the 5 categorisations of the use cases.

Use cases 1-4 are set in advance per season and represent a pre-emptive approach intended to reflect the generally recognised demand and generation patterns for electricity. To this extent it should be possible to have every site and most assets reflecting the improved understanding of energy usage relating to its location and other energy related factors. It is vital to recognise that this will not always be the same between sites and may often differ from national energy consumption patterns, which are an aggregation of overall behaviour.

For example, a demand site that is located close to a large conurbation will probably be quite different from a rural one located close to a solar farm, and different again from one near a wind farm. As this approach is applied over relatively long service durations of several months then the expectation is that this would be achieved through automated timers on assets or alteration of the times at which manual actions take place as part of operational guidance to staff. Although the operational and technology barriers are low, it is anticipated that the resulting impact to network constraints will also be relatively low.

5.2 Method B

Use cases 5-8 represent a moderate increase in complexity and improved value to the electricity network by shifting from a seasonal approach that would have feasible value across the entire network, to a more targeted method. Rather than basing perturbation on a seasonal basis, the requirement would be reduced to weekly applications of flexibility delivery.

Even within this increased granularity there is scope for options in how the service is developed and we would expect this to be further investigated within future innovation projects. Even if the water authority were to agree to schedule their flexible capability on a week-by-week basis, it has not been established as to whether this could be done seasonally or subject to week ahead requests.

On this basis we may see the number of future use cases expanded out to reflect a larger number of feasible service types. It should be noted that at this time we recognise that the DSO would need to enhance its own capabilities around analysis in order to manage the exponential expansion in effort to carry out widespread forecasting on a weekly basis right across the network. As the services are based on the principle of pre-scheduling it remains viable that this could be implemented by means of manual intercession as well as automation.

5.3 Method C

The next three use cases 9-11 still have a theoretic potential of being performed but have to be balanced against the risk of unwanted burden on operations within any water authority, as the reduction in notice from a weekly schedule to a 30 minute should be recognised as a dispatch requirement. DSOs already have experience of regularly dispatching services at a 15-minute notice through the Flexible Power services.

Within this programme the flexibility providers are required to connect via an API communications link and ensure that they respond rapidly to ensure the notification is acted upon and demand shift achieved within the 15 minutes to avoid any penalties. Based on this experience it is recognised that 30 mins will most likely present a challenging target for Water Authorities to achieve through manual actions and could result in unsatisfactory quality of service delivery if delayed or missed. For the reasons given we would anticipate that there would be a limited number of sites for which this would be an enduring arrangement and would probably only be used in the case of transient constraint conditions or as a temporary operating state in advance of a more automated approach.

5.4 Method D

Automation is introduced as a requirement in 12-14 in line with the reduction in the response time to 15 mins. This has many parallels with the current services from Flexible Power mentioned previously. With the introduction of automation as a prerequisite it would be pragmatic to also include feedback from the sites to include at least an acknowledgment that that dispatch has been received and enacted.

The preferable solution to this would be the addition of metering from the active sites which would reflect the standards expected from the Flexible Power. Most providers for Flexible Power are required to submit metering at 1 minute granularity, primarily for performance measurement and settlement rather than live monitoring. As the proposal for FLOWERS is to embed water industry flexibility without direct payment then half-hour granularity may be acceptable if the more detailed data would present a practical barrier to commissioning.

5.5 Method E

The two final use cases 15 & 16 are intended as a post-fault service and are presumed to require some form of automation to achieve due to the response time of 1 minute. There may be some sites able to use existing ‘loss of mains’ mitigation schemes to offer an appropriate action without substantial investment in remote dispatch capability. In certain circumstances the fault to the network may result in an interruption of service and any sites that have back up generation or batteries would be expected to switch to self-supply for critical processes. This would in effect not require additional automation as it should already be operational in response to the local conditions but by delaying the return to mains by an additional 15 mins or more after restoration, it would provide the necessary support to the network by reducing stress while systems can be stabilised.

5.6 Summary Table

Methods A to E are summarised in the following table, outlining the key characteristics, and associating them with the 16 use cases that have been developed within the project to date.

(Method) Use Case	Conventional or Reverse	Dispatch Method	Minimum Duration (min)	Minimum Capacity (kW)	Frequency of use	Visibility	Seasons	Comments				
								Wastewater ST	Wastewater MD	Drinking Water WT	Drinking Water WD	Control Communication
(A) 1	Conventional	Seasonal	60	50	All	None	All	Not possible by flexing processes but could be implemented by utilising on site generation.	Could be implemented by utilising on site generation.	Not by flexing processes but by utilising on site generation	Could be implemented by utilising on site generation.	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(A) 2	Conventional	Seasonal	60	50	weekdays	None	Winter	Not possible by flexing processes but could be implemented by utilising on site generation.	Could be implemented by utilising on site generation.	Not by flexing processes but by utilising on site generation	Could be implemented by utilising on site generation.	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(A) 3	Reverse	Seasonal	60	50	All	None	All	Not currently possible by flexing processes but could be implemented by utilising on site batteries	Could be implemented by utilising on site batteries	Not by flexing processes but by utilising on site batteries	Could be implemented by utilising on site batteries	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(A) 4	Reverse	Seasonal	60	50	Weekends	None	Summer	Not currently possible by flexing processes but could be implemented by utilising on site batteries	Could be implemented by utilising on site batteries	Not by flexing processes but by utilising on site batteries	Could be implemented by utilising on site batteries	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(B) 5	Conventional	Weekly scheduling	60	100	Weekdays	None	All	Not possible by flexing processes but could be implemented by utilising on site generation.	Could be implemented by utilising on site generation.	Not by flexing processes but by utilising on site generation	Could be implemented by utilising on site generation.	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.

(B) 6	Conventional	Weekly scheduling	60	100	Weekdays	None	Winter	Not possible by flexing processes but could be implemented by utilising on site generation.	Could be implemented by utilising on site generation.	Not by flexing processes but by utilising on site generation	Could be implemented by utilising on site generation.	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(B) 7	Reverse	Weekly scheduling	60	100	All	None	All	Not currently possible by flexing processes but could be implemented by utilising on site batteries	Could be implemented by utilising on site batteries	Not by flexing processes but by utilising on site batteries	Could be implemented by utilising on site batteries	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(B) 8	Reverse	Weekly scheduling	60	100	Weekends	None	Summer	Not currently possible by flexing processes but could be implemented by utilising on site batteries	Could be implemented by utilising on site batteries	Not by flexing processes but by utilising on site batteries	Could be implemented by utilising on site batteries	Strategic Flexibility Planning Teams from NGED and SWW. Would need day ahead confirmation.
(C) 9	Conventional	30 min manual	60	200	all	None	all	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW
(C) 10	Conventional	30 min manual	60	200	weekdays	None	winter	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW

(C) 11	Reverse	30 min manual	60	100	weekends	None	Summer	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW
(D) 12	Conventional	15 min automated	30	200	all	Status confirm	all	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW
(D) 13	Conventional	15 min automated	30	200	weekdays	Status confirm	winter	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW
(D) 14	Reverse	15 min automated	30	100	weekends	Status confirm	Summer	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW
(E) 15	Conventional	1 min automated	15	200	weekdays	Status monitor	winter	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW

(E) **16**	Reverse	1 min automated	15	100	weekends	Status monitor	Summer	Potentially by flexing processes dependent on rain status and forecast	Would need to be Automatic and prob min size 20 kW	Potentially by flexing processes dependent on demand and reservoir levels	Would need to be Automatic and prob min size 20 kW	Control Room to Control Room with immediate confirmation of dispatchability by SWW

6 Technical Solutions

The majority of sites assessed for FLOWERS have been solely through desktop analysis and only a very limited number of sites were subject of a visit. From this initial review of capabilities there is very limited capacity that can be accessed straightaway without some form of remedial works to enable any of the methods outlined in the this document. A more detailed breakdown and an estimate of the overall potential is available in a separate document (D5-1 Case Study Report). There are a variety of different flexible technologies across the available assets within the SWW estate that could provide flexibility potential. These range from generation through to water treatment processes such as pumping and treatment.

The purpose of this document is not to propose a solution for the specific SWW assets as forecasting of usage and control of such assets remotely is not justifiable innovation within the scope of this project. There are many off the shelf solutions to monitoring and control and the water industry have been using SCADA[1] (Supervisory Control and Data Acquisition) systems for several decades. Some of the SWW generators would benefit from replacement or upgrades for reliability as well as permissions to run in parallel with the network to make them viable. This should also be a BaU activity and therefore falls outside of the scope for innovation.

Within this document, the technical solutions are only intended to deal with the upstream communications and process protection between the asset owner and the DSO requiring the flexibility services. These have been separated by the methods previously outlined. With the value of the method to the DSO increasing with in line with the controllability of assets. It will be preferable to migrate sites from Method A & B scheduled services towards C, D & E. Some larger sites may be able to support multiple methods if they have multiple asset types within the location.

Prior to implementing any of the methods it will be necessary for all sites to undergo an inspection and assessment of the assets, processes, historic energy data and finally an economic cost benefit analysis. This will be with the objective to establish the how much flexibility is currently available and what capacity could potentially be offered through each method versus the commissioning costs.

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[1] SCADA systems are used for controlling, monitoring, and analysing industrial devices and processes. The system consists of both software and hardware components and enables remote and on-site gathering of data from the industrial equipment. In that way, it allows companies to remotely manage industrial sites such as water treatment, because they can access the asset data and control them without being on site.

The purpose of the lowest value method is to create an entry point to participation for water sites that either have a low volume of capacity or poor compatibility with any of the more integrated methods and too costly upgrade. Alternatively, this may be the starting point for sites to start harnessing flexibility ahead of upgrades to improve the ability to implement the more advanced methods.

The pre-flexibility assessment will most likely identify a greater volume of capacity through method A than the more advanced mechanisms, simply because it is typically easier to provide services with increased notice of the requirements. It is also expected that the enablement costs will be low. There will be some assets however that we would not wish to encourage to be made available on a regular pre-scheduled basis. This will include generation assets such as stand-by generators that shouldn't be incentivised to run excessively due to environmental impacts and the cost associated with diesel fuel and maintenance.

6.1 Method A

The site assessment should establish the processes that include aspects of flexibility that can feasibly be altered in line with any conditions on the distribution network that serves it. The aim is to reduce peaks in demand and generation by shifting processes with the opposite action into the relevant periods. These can shift seasonally for both water and electricity demand so the intention would be to create operational guidance plans for each season with a forecast of the expected impact.

Services may not be required year-round and may only be required for a limited number of seasons each year. This will typically be generation peaks in the summer and demand in the winter under normal conditions, although planned maintenance can also trigger requirements outside of typical periods if the network is operating at reduced capacity. These will be of a minimum of 50kW within a network zone and delivery must be for at least 60 mins per day.

The intention for Method A implementations is to avoid any costly upgrades or additional equipment to facilitate service delivery. The DSO should indicate the periods during which flexibility should be attempted and in response the water companies should confirm the estimated capacity and make the necessary arrangements to implement the process adjustments. These can be verified by the half-hourly data if necessary.

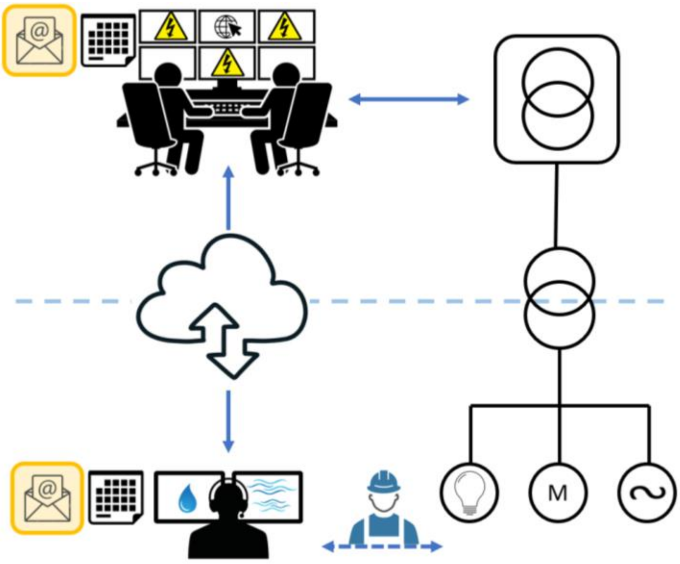

Figure 6-1 Seasonal arrangements scheduled manually with no direct communications

6.2 Method B

Similar to Method A, Method B does not rely heavily on technical solutions in order to facilitate the flexibility delivery as there is no active dispatch requirement. The scheduling intervals reduce from seasonal to weekly, which can still be achieved without the need for expensive or onerous systems. This can feasibly be achieved through email or a secure messaging service for the DSO to indicate the relevant periods which are still subject to a minimum duration of 60 mins. However, due to the additional resource burden of weekly administration the minimum capacity per zone increases to 100kW.

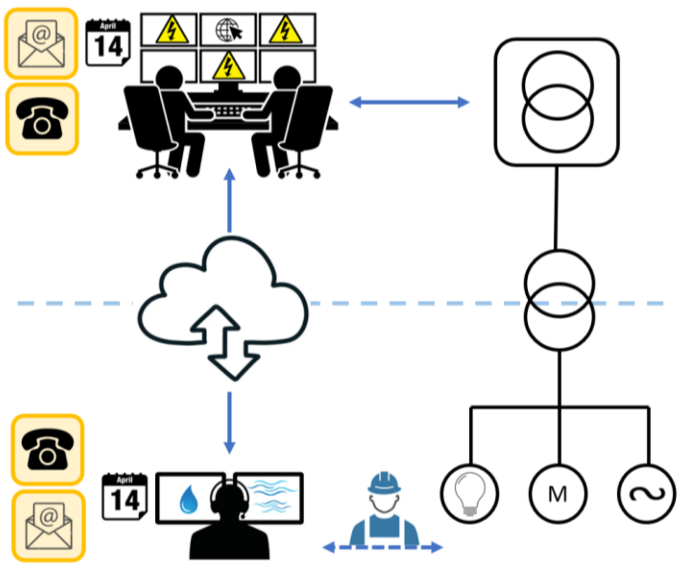

Figure 6-2 - Weekly arrangements scheduled manually with simple communications

6.3 Method C

As Method C requires a 30-minute response time it is the first of the services that requires a dedicated dispatch capability. It is acceptable to automate the dispatch signal to trigger the action on site but not necessary if there is the ability to receive the notification and action it within the 30 minutes.

The DSO will use the systems already developed within Flexible Power to manage the event dispatch and cease signals. Due to adoption of this principle the signal will be sent using an API which will require the water authority to establish a monitored 'endpoint' to receive notifications. The API is secure but there is no requirement to create an endpoint within the water corporate network as it will be using public internet as the communications environment and this may be perceived to open up new cyber vulnerabilities.

An endpoint can be created on a wide variety of devices, including a standalone digital device such as a PC or server if it is internet connected. Method C also refrains from specifying what action must be taken when the notifications are received to deliver flexibility for the event. The API endpoint will need to be monitored and able to provide an alert to an employee to commence the event on time. This can be as simple as a flashing light or audible notification. Any processes changes or generation will then be altered manually if on site or via SCADA if API is to a central control facility. A return signal by the API can be used to acknowledge receipt and confirm dispatch of assets.

In order to justify the added effort associated with this method and the reduced frequency of usage, the minimum capacity ranges between 100-200kW to help ensure that the effort associated with commissioning is realised.

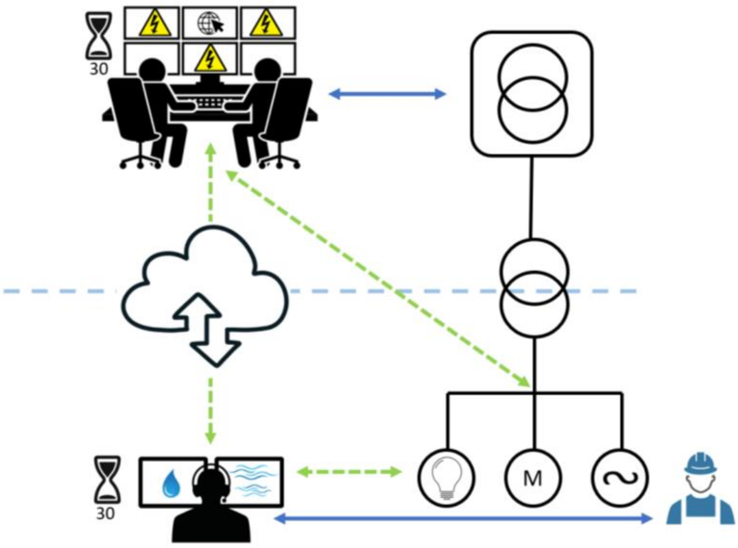

Figure 6-3 – Dispatchable with 30 minutes notice requiring API to site or central control.

6.4 Method D

Method D also utilises the API dispatch capability of Flexible Power as the dispatch notification period is reduced to 15 mins and the minimum duration is also reduced to 30 mins. Automation is preferred due to the necessary speed of response. In most other respects the services have the same limits.

If automation is installed a return signal by the API can report acknowledgement and confirm dispatch of assets. This could take the form of a metering signal using the existing Flexible Power standards.

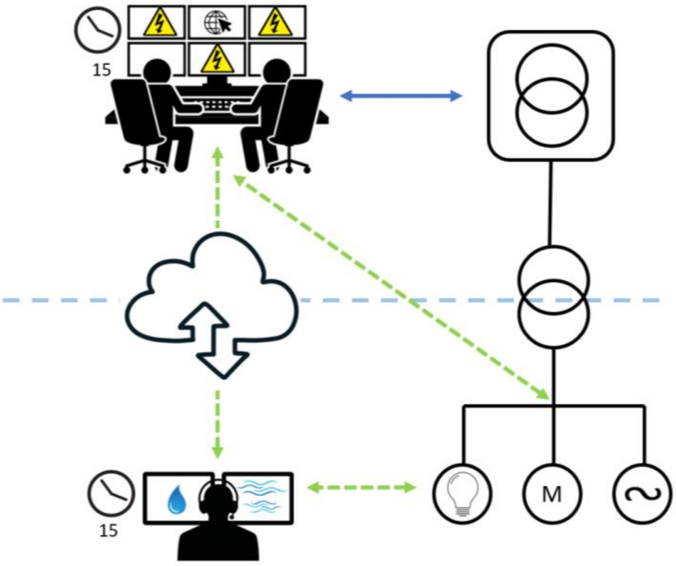

Figure 6-4- Dispatchable with 15 minutes notice requiring API direct to assets with no manual interventions

6.5 Method E

Method E is likely to be applicable to a subset of the assets that already participate in Method D but with the ability to respond quicker and therefore only applicable where automation is available. The technical solution is otherwise identical.

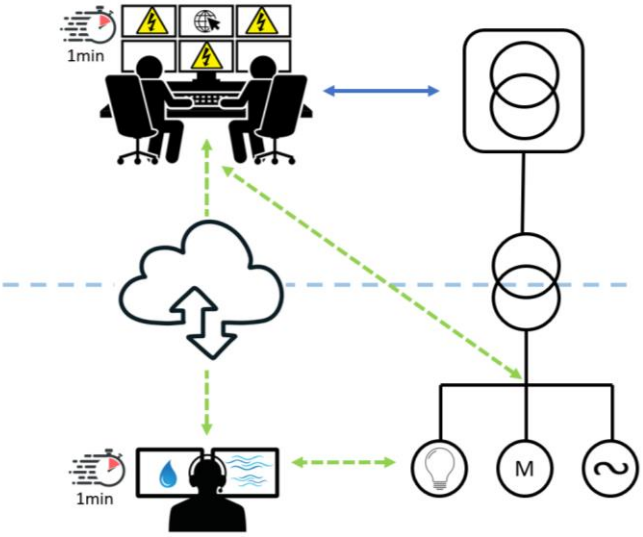

Figure 6-5 - Dispatchable under 1 minute notice requiring API direct to assets with no manual interventions

7 KEY CAPABILITY DEVELOPMENTS AND CHALLENGES

The following is a summary of the key capabilities that need developing and the key challenges that need overcoming to enable realisation of the embedded flexibility within the SWW network.

7.1 Key Capabilities That Need Developing

All the methods described in the previous sections will require development of the following capabilities.

- Energy half hourly submetering of the separate operational loads to confirm each operational loads demand.
- Pump workload forecasting using weather and demand data to enable future planning for provision of energy flexibility.
- Live storage tank fill levels and forecast fill levels for all sites visible to the control room to enable confirmation of proposed energy flexibility and to enable the management of storage between linked sites.
- A common centralised approach for the remote control of pumping at all sites.
- A close to real time methodology to confirm to the DSO the sites' ability to be dispatched (this is needed due to the exponential impact recent and forecast weather has on energy demand).

Method Specifics (all of the above plus)

- Method "A" Seasonal & Method "B" Weekly – Onsite energy storage, to source the site electricity needs from an alternative source than the electricity network, would be needed to ensure the energy demand peturbation could be implemented regardless of weather impact.
- Method "C" 30 Min response time - will require the establishing of a monitored 'endpoint' to receive API notifications to implement energy perturbations.
- Method's "D" 15 Min response & Method "E" 1 Minute response - will require automated implementation of energy perturbations and confirmation of implementation back to the DSO.

7.2 Key Challenges

- Pre-planning for the delivery of flexibility, greater than day ahead of real time, will fundamentally be impacted by the recent past weather, forecast weather, forecast demand (drinking water), forecast treatment volumes (wastewater) and the current amount of liquid being processed and stored at the pumping stations and the treatment works.

    - The flow into the Wastewater treatment works is constant with volumes predominantly driven by rainfall events.
    - The flow into and out of Drinking Water treatment works is constant with volumes driven by demand.
- The rate and volumes that need to be treated, as stipulated by the relevant site licences, could impact the ability to deliver energy flexibility.
- The main energy load centres, being the treatment works, will not necessarily be able to be perturbed in isolation of the pumping stations that feed into the treatment works or of the pumping stations after the treatment works.
    - Wastewater - The level of storage fill of the pumping stations that feed in to the treatment works needs to be known before pumping turn down can be implemented to determine how long the pumps could be turned down for.
    - The lag time of the flow of liquid from the pumping stations above needs to be considered for implementation of pumping turn down at the treatment sites.
    - If the treatment sites are pumped distribution post treatment rather than gravity, then the work rate of these distribution pumps will potentially need to be turned down to match the reduced treatment volumes
- Drinking water - The level of water storage of the distribution reservoirs needs to be known, with forecast demand needing to be understood before pumping of the treated water from the treatment plant can be turned down.
    - The lag time of the flow of liquid from the extraction points pumping stations needs to be considered for implementation of pumping turn down at the treatment sites.
    - If the treatment sites are pumped distribution post treatment rather than gravity, then the fill level triggers of the distribution reservoirs need to be held off.
- For pre-planned energy flexibility, months ahead, the only firm perturbation method would be to source the electricity needs from an alternative source than the electricity network.
    - Battery storage could be implemented to maximise the benefit of any onsite PV generation by storing the energy generated for use at the peak/constraint time.
    - Battery storage could also be used to take advantage of any demand turn up services linked to local over generation which could also support reduction of implementation of ANM.
    - Current onsite generators could be utilised with changes to the fuel to account for the emissions. There is potential to outsource the management of the SWW generator fleet.